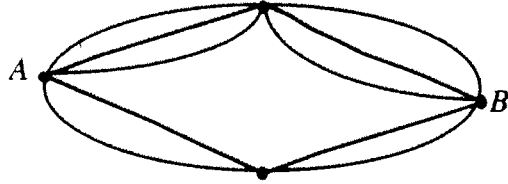# Permutations and Combinations Lesson #9:
Practice Test

Sec A *No calculator may be used for this section of the test.*

1. How many routes are there from A to B if each route must always move closer to B?

   A. 10
   $(3 \times 3) + (2 \times 2)$

   B. 13
   $= 9 + 4$

   C. 24
   $= 13$

   D. 36

2. How many arrangements of all of the letters in the word **NOISE** are possible if the vowels, **E, I,** and **O**, must be together but not necessarily in that order?

   A. 6

   B. 12
   $EIO--$
   $3! \times 3!$

   C. 18

   D. 36
   $= 6 \times 6$

3. A committee consists of eleven elected members. From this committee, a President, a Treasurer, and a Secretary have to be chosen. In how many ways can this be done? *order is important*

   A. $_{11}P_3$ B. $_{11}C_3$ C. 11^3 D. $\dfrac{11!}{3!}$

4. Six children and five adults are to be seated in a row so that none of the children sits beside another child. The number of different ways in which this can be done is

   A. 11!   B. $6! \times 5!$ $C_1 A_1 C_2 A_2 C_3 A_3 C_4 A_4 C_5 A_5 C_6$

   C. $_{11}C_6 \times {}_5C_5$ D. $_6C_6 \times {}_5C_5$ $6! \times 5!$

Numerical Response 1. A car dealership has 5 **different** models of car in the showroom. The 5 cars are to be displayed in a straight line. Three of the cars are blue, one is black and one is green.

The number of ways in which all of the cars can be displayed in the showroom if *no two blue cars* can be next to one another is _____.

(Record your answer in the numerical response box from left to right.)   `| 1 | 2 |  |  |`

$\overline{B_1} - \overline{B_2} - \overline{B_3}$ $3!$ for blue cars
$2!$ for others

$3! \, 2! = 6 \times 2 = 12$

5. An alternative form of the expression $\dfrac{(n+2)!}{n(n-1)!}$ is

   A. $(n+2)(n+1)$

   B. $\dfrac{(n+2)(n+1)}{(n-1)}$

   C. $\dfrac{(n+2)(n+1)}{n}$

   D. $\dfrac{(n+2)(n+1)}{(n-1)!}$

$\dfrac{(n+2)(n+1)(n!)}{n!}$ or $\dfrac{(n+2)(n+1)(n)(n-1)}{n(n-1)!}$

$= (n+2)(n+1)$

Section B   *A graphing calculator may be used for the remainder of the test.*

6. The number of different 6-letter permutations of all of the letters in the word **BANANA** is

   A. 60   B. 120

   C. 144   D. 720

   $3A$ $\quad = \dfrac{6!}{3!\,2!}$

   $2N$

7. The schedule in a soccer league consists of each team playing every other team twice. If there are six teams in the league, the total number of games on the schedule is

   A. 60   B. 36

   C. 30   D. 15

   $_6P_2$

   $= 30$

8. A committee of 6 students is to be selected from 5 boys and 6 girls. How many different committees are possible if there must be an equal number of boys and girls on the committee?

   A. $_{11}C_6$ B. $_5C_3 \times {_6}C_3$

   C. $_{11}C_3 \times {_6}C_3$ D. $_5C_1 \times {_6}C_1$

   $3G$ $3B$

   $\left(_5C_3 \right)\left(_6C_3 \right)$

   $=$

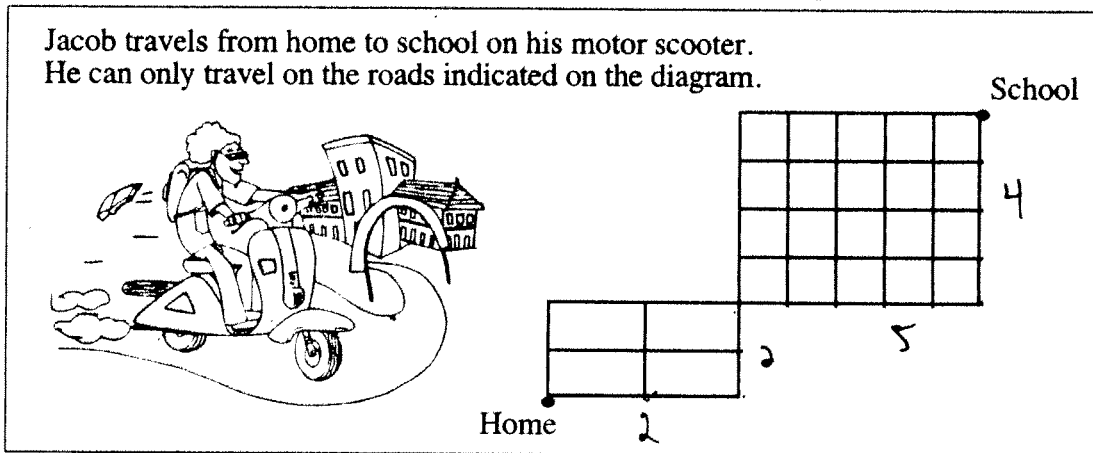**Numerical Response 2.** A computer access code consists of three **different** digits followed by one of the letters A, B, C, or D.
If the first digit in the access code cannot be zero, then the number of different access codes possible is _____.

(Record your answer in the numerical response box from left to right.)

2	5	9	2

$\dfrac{9 \times 9 \times 8 \times 4}{\uparrow 0} = 2592$

Use the following information to answer the next question.

Jacob travels from home to school on his motor scooter.
He can only travel on the roads indicated on the diagram.

School

4

5

Home 2

9. The number of different routes he can take without backtracking is

$$\left(\frac{4!}{2!2!}\right)\left(\frac{9!}{5!4!}\right)$$

$$= 6(126)$$

$$= 756$$

    A. 132

    B. 756

    C. 1716

    D. 9240

10. The sum of the coefficients in the expansion of $(a+b)^5$ is

$$2^5 = 32$$

    A. 64

    B. 32

    C. 16

    D. 6

11. Al's Pizza is to expand its operation by opening 4 new stores in Calgary, 1 new store in Red Deer, and 3 new stores in Edmonton.

If there are 6 possible locations in Calgary, 4 possible locations in Red Deer, and 4 possible locations in Edmonton, then the number of ways in which the 8 different locations can be chosen is

Calgary   RD   Ed.

$$\left({}_6C_4\right)\left({}_4C_1\right)\left({}_4C_3\right)$$

$$= 15(4)(4)$$

$$= 240$$

    A. 12

    B. 165

    C. 240

    D. 34560

Numerical Response 3. The "special" menu at a fast food restaurant allows you to choose one sandwich, one drink and one cookie for a price of $5.99. The choices available are shown in the table.

Sandwich	Drink	Cookie
Ham	Orange	Chocolate Chip
Beef	Milk	Coconut
Turkey	Cola	
Tuna		
Chicken Salad		

$5 \times 3 \times 2 = 30$
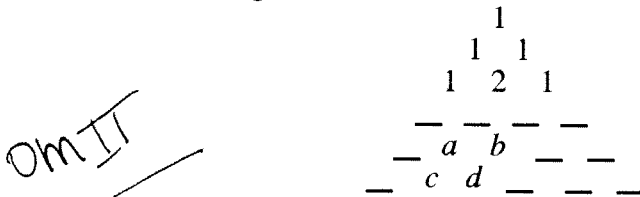
Fundamental principle counting

The number of different ways that a student can choose a meal from the special menu, consisting of one sandwich, one drink, and one cookie, is _____.

(Record your answer in the numerical response box from left to right.) | 3 | 0 | | |

12. Part of Pascal's Triangle is shown.

$$
\begin{array}{ccccccc}
 & & & 1 & & & \\
 & & 1 & & 1 & & \\
 & 1 & & 2 & & 1 & \\
 \_ & \_ & \_ & \_ & \_ & & \\
 & \_ & a & & b & \_ & \_ & \_ \\
 \_ & & c & & d & \_ & \_ & \_ & \_ \\
\end{array}
$$

OMIT

Which entry in the triangle is equivalent to $_5C_2$?

A. *a*   **B.** *b*   **C.** *c*   **D.** *d*

13. A 5-card hand is dealt from a standard deck of 52 playing cards. The number of different hands containing 4 diamonds and 1 spade is

A. 9 295

B. 18 590

C. 223 080

D. 1 115 400

$\left(_{13}C_4\right)\left(_{13}C_1\right) = 715(13)$

$= 9295$

Numerical Response 4. If $\dfrac{n!}{(n-2)!} = 240$, the value of n is _____ .

(Record your answer in the numerical response box from left to right.)

$\boxed{1}\boxed{6}\boxed{}\boxed{}$

$$\frac{n(n-1)(n-2)!}{(n-2)!} = 240$$

$$n^2 - n - 240 = 0$$

$$(n-16)(n+15) = 0 \qquad n = 16, \; \cancel{-15}\; \text{reject}$$

14. Rajinder and six of his friends are in a line-up to buy tickets for a movie. The number of ways in which they can line up if Rajinder is first in the line is

A. 20 **B.** 120

(C.) 720 **D.** 5040

7 ppl.
$$\underline{R} \, | -\,\overline{-}\,\overline{-}\,\overline{-}\,\overline{-}\,\overline{-}$$
$$6! = 720$$

15. If all of the letters in the word **FLAGPOLE** are used, then the number of different 8-letter arrangements that can be made ending with 3 vowels is

A. 4320

B. 720

(C.) 360

D. 120

$$2L \quad \frac{5!}{2!} \quad (AOE)\; 3!$$

$$= \left(\frac{5!}{2!}\right) 3!$$

$$= 360$$

Numerical Response 5. One of the terms in the expansion of $(2x+3)^5$ can be written in the form cx^2. The value of c is _____ .

(Record your answer in the numerical response box from left to right.)

$\boxed{1}\boxed{0}\boxed{8}\boxed{0}$

$$x \to 2x \qquad t_{k+1} = {}_nC_k \, x^{n-k} y^k$$
$$y \to 3 \qquad = {}_5C_k (2x)^{5-k} (3)^k$$
$$k \to k \qquad = {}_5C_k \, 2^{5-k} x^{5-k} 3^k$$
$$n \to 5$$

$$\text{term in } x^2 \quad 5-k = 2 \quad k = 3$$

$$t_4 = {}_5C_3 (2^2)(x^2)(3^3)$$

$$= 10(4)(27)x^2$$

$$= 1080x^2$$

16. Ten students in a leadership class at Memorial High School are going to do some volunteer work. Five of the students will volunteer at the Food Bank, two of the student will volunteer at the Central Hospital and the remaining three students will volunteer at Memorial Elementary School.

The number of ways in which the ten students can be assigned to these three locations i:

A. 417

B. 2520

C. 845 020

D. 1 360 800

$$\left(_{10}C_5\right)\left(_5C_2\right)\left(_3C_3\right) = 252(10)(1)$$
$$= 2520$$

17. The number of 7-letter arrangements of all of the letters of the word **SAILING** in which all the vowels are together is

A. 72

B. 144

C. 360

D. 720

$$\_\ \_\ \_\ \_\ \mid AII$$
$$5! \times \frac{3!}{2!}$$
$$= 360$$

18. In the expansion of $(3a - 2b)^7$ the coefficient of the term containing a^2b^5 is

A. −6048

B. 6048

C. −126

D. 126

$$x \to 3a$$
$$y \to -2b$$
$$k \to k$$
$$n \to 7$$

$$t_{k+1} = {}_nC_k x^{n-k} y^k$$

$$= {}_7C_k (3a)^{7-k}(-2b)^k$$
$$= {}_7C_k 3^{7-k} a^{7-k}(-2)^k b^k$$
$$t_6 = {}_7C_5 (3^2)a^2(-2)^5 b^5$$
$$= 21(9)(-32)a^2 b^5 = -6048a^2 b^5$$

term in a^2b^5
$$k = 5$$

19. A Graduation Committee of 6 students is to be selected from the 4 males and 6 females on the Student Council.
How many Graduation Committees are possible if the President of the Student Council, who is female, must be on the committee?
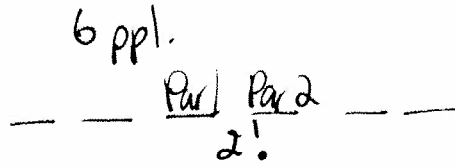
A. 84

B. 126

C. 210

D. 252

4M 5F → need only 5 b/c female pres is on.
$$_9C_5 = 126$$

20. Mr. and Mrs. LaMarre want a family photograph taken with their four children. In how many ways can the family stand in a straight line if the parents must occupy the two middle positions in the line?

A. 4   B. 24

C. 48   D. 120

6 ppl.

Par1 Par2

____ ____ Par1 Par2 ____ ____

2!

4! children

2! parents

= 4!·2! = 48

Use the following information to answer the next question.

Pizza Palace uses the following advert to promote its pizzas.

Pizza Palace

1024 Different Pizzas Available

$10.99 to $18.99.   Tel. (123) 456-7890

Customers can choose from 1024 different 14-inch pizzas. Each pizza contains cheese and you can have a plain cheese pizza or add any number of the available toppings.

Numerical Response

6. The number of different toppings available to a customer is _____ .

(Record your answer in the numerical response box from left to right.)

| 1 | 0 | | |

$$_nC_0 + {}_nC_1 + {}_nC_2 + {}_nC_3 \dots {}_nC_n = 1024$$

$$2^n = 1024 \qquad 2^n = 2^{10} = 1024$$

Written Response

1. The Riverview High School Games Club meets once a week to play a variety of card and board games. The club currently has 14 male and 16 female members.

- Four members of the club are selected to play the card game "euchre".

  How many ways can those four players be selected from the 30 members of the club?

$$_{30}C_4 = 27405$$

- The game of "euchre" only uses 24 cards from a standard deck. All cards are removed except the 9's, 10's, jacks, queens, kings, and aces, which are used for the game.

  How many five card hands of "euchre" can be dealt that have exactly 2 red cards? *+3 black*

24 cards

12 red 12 blk.

$$({}_{12}C_2)({}_{12}C_3)$$

$$= 66(220)$$

$$= 14520$$

Written Response

2.

Phil is a golf professional at a local private golf course. He owns many golf clubs, and will choose the clubs he uses to play a particular round of golf based on weather conditions, course conditions, and course length. His clubs are categorized by drivers, fairway woods, irons, wedges, and putters. The chart below shows the golf clubs Phil currently owns.

Drivers (3)	Fairway Woods (4)	Irons (8)	Wedges (4)	Putters (3)
11° loft	3 wood	2 iron	60° lob wedge	Blade putter
10° loft	5 wood	3 iron	56° sand wedge	Mallet putter
8.5° loft	7 wood	4 iron	52° gap wedge	2-ball putter
	9 wood	5 iron	48° pitching wedge	
		6 iron		
		7 iron		
		8 iron		
		9 iron		

- Phil is giving a golf lesson today, and he will take one driver, one iron, and one wedge to the driving range. In how many ways can he select the three clubs he will use for the lesson?

$$3 \times 8 \times 4 = 96$$

- One of the official rules of golf states,

   "The player must start a stipulated round with not more than 14 clubs."

Before each round, Phil must choose the 14 clubs he will use for that round. For tomorrow's round, Phil will choose 1 driver, 3 fairway woods, 6 irons, 3 wedges and his mallet putter. In how many ways can Phil choose the 14 golf clubs he will use in tomorrow's round?

Driver   Woods   Irons   Wedge
$$(_3C_1)\ (_4C_3)\ (_8C_6)\ (_4C_3)(1) = 1344$$

Answer Key

Multiple Choice

1. B	2. D	3. A	4. B
5. A	6. A	7. C	8. B
9. B	10. B	11. C	12. D
13. A	14. C	15. C	16. B
17. C	18. A	19. B	20. C

Numerical Response

1. | 1 | 2 | | |

2. | 2 | 5 | 9 | 2 |

3. | 3 | 0 | | |

4. | 1 | 6 | | |

5. | 1 | 0 | 8 | 0 |

6. | 1 | 0 | | |

Written Response

1. • 27 405
   • 14 520

2. • 96
   • 1344